the United States. The preliminary report on the operations of the plant, drawn up by Messrs. E. W. Parker, J. A. Holmes, and M. R. Campbell, the committee in charge, has been issued as Bulletin No. 261 of the United States Geological Survey, and is of far-reaching importance in the solution of the fuel and power problems upon which the varied industries of the United States depend. Most of the American bituminous coals and lignites can, it was found, be used as a source of power in a gas-producing plant, the power efficiency of bituminous coals when thus used being $2\frac{1}{2}$ times greater than their efficiency when used in a steam-boiler plant. Some of the lignites from undeveloped but extensive deposits in North Dakota and Texas showed unexpectedly high power-producing qualities. It was found, too, that some of the American coals and the slack produced in mining them could be made into briquettes on a commercial basis.

THE weather over the British Islands has been very unsettled during most part of the last week, rainfall being very prevalent generally; in the south of England and all the western districts the amount was much above the average. Strong gales occurred in many places, especially on the western and southern coasts, and the sea has been very rough at times. The Meteorological Office reports on Tuesday showed a considerable improvement, with clear sky over most parts of the kingdom, but a renewal of unsettled weather was anticipated in the western and northern districts. The rainfall from January 1 is still below the average in most districts, the deficiency amounting to about four inches in the north-east of England, but in the north of Scotland and Ireland the fall is considerably above the average.

THE assistant director of the Meteorological Service of Canada (Mr. B. C. Webber) has prepared a very useful paper entitled "The Gales from the Great Lakes to the Maritime Provinces." The tables show the number of areas of low barometric pressure, and gales, with information regarding them, for each month of thirty-one years (1874–1904). The results are published primarily for the use of the forecast officials in the Dominion, but they are valuable for reference by other persons. On the average, November is the stormiest month on the Great Lakes, and January in the Maritime Provinces; December and February also give a high percentage of storms. The diminution in the number of gales in March and September is opposed to the old idea of the stormy character of the periods of the equinoxes. The author states that the figures afford ample ground for suspicion that towards the maximum of sun-spots there is a maximum of low pressure areas, and that at the sun-spot minimum there is a paucity of such areas. The work has, of course, been prepared under the direction of Mr. R. F. Stupart, the director of the service.

WE have received the *Jahrbücher* of the Austrian Central Office for Meteorology and Terrestrial Magnetism for the year 1903; the work consists of two large quarto volumes, containing (1) carefully prepared results of 400 stations, and (2) special discussions, including an important contribution by M. Margueles on the energy of storms, being an elaborate mathematical analysis of that branch of the physics of the atmosphere; a discussion of much interest for weather prediction, by Dr. F. M. Exner, in connection with the behaviour of the weather during conditions of high atmospheric pressure to the north of the Alps, illustrated by a number of weather charts; also comprehensive researches relating to the formation and propagation of thunder and hail storms, by K. Prohaska. We have before directed attention to the value of the observations made at the high-level stations in the Austrian system; thirty-two of them have an altitude of 1000 to 1500 metres, fifteen others from 1500 to 2500 metres, and the Sonnblick 3106 metres. Meteorologists are much indebted to Dr. Pernter, the able director of the service, for the publication *in extenso* of the hourly results at some of these mountain stations.

MR. WM. BUTLER, of 20 Crosby Road, Southport, whose "swingcam" camera stand was referred to in NATURE of May 25 (p. 89), has sent us a series of twelve small prints of photographs of the recent partial eclipse taken by his son, who is only fifteen years of age, with the use of the apparatus. The pictures are clear, and show several phases of the partial eclipse very distinctly.

A LIST of scientific papers published by the National Physical Laboratory, or communicated by members of the staff to scientific societies or institutions, or to the technical journals, has just been issued. During 1900 and 1904, thirty-three papers on work connected with the laboratory were prepared and published by members of the staff, and in addition eleven papers were published by members of the staff independently.

MESSRS. MACMILLAN AND CO., LTD., will publish shortly "The Chemistry of the Proteids," by Dr. Gustav Mann, of the physiological laboratory at Oxford. This book is based upon the second edition of Dr. Cohnheim's "Chemie der Eiweisskörper," and has been prepared with the author's sanction. Dr. Cohnheim's work, which in its second edition has been entirely re-modelled, is of special interest to professional chemists, both organic and inorganic, but particularly to biologists, including zoologists, physiologists, and pathologists; while among the special features of Dr. Mann's book are, that for the first time the chemical derivatives of albumins and proteids are so arranged as to give a clear idea of the evolution from simple into more complex compounds, and for the first time also a very full account of the synthetic work of Curtius and Fischer is given.

OUR ASTRONOMICAL COLUMN.

NOVA AQUILÆ NO. 2.—Very little further news of Nova Aquilæ is yet to hand, but Circular No. 79 of the Kiel Centralstelle informs us that several visual observations of the star's magnitude and position have been made.

Prof. Max Wolf reports that, according to observations made at the Königstuhl Observatory on September 4, at 9h. 30·0m. (Königstuhl M.T.), the magnitude was 9·3. The position was determined as R.A. = 18h. 54m. 24s., dec. = $-4° 39'$ (1855).

A telephone message to Kiel from Dr. P. Guthnick on September 6 gave the following positions:—

1855.	R.A. = 18h. 54m. 25s.,	decl. =	$-4° 38'·8$
1905.	,, 18h. 57m. 4s.,	,,	$-4° 34'·8$

and stated that the magnitude on September 5 was about 10·2, whilst the star was of a yellowish colour. A star of magnitude 10·5 precedes the Nova by 10s., and is $0'·7$ north of it. As the present Nova is the second known to have appeared in the constellation Aquila, it will be designated, according to precedent, Nova Aquilæ No. 2. The first Nova Aquilæ was discovered in July, 1900, on one of the Draper memorial chart plates which had been taken on July 3, 1899, and exhibited the characteristic "Nova" bright-line spectrum. The object itself was recorded for the first time, as a seventh magnitude star, on a plate taken on April 21, 1899.

VARIATION OF A NEWLY DISCOVERED ASTEROID.—According to a telegram from the Kiel Centralstelle, Dr. Palisa has found that the minor planet 1905 QY, which was discovered by Prof. Max Wolf on August 23, is subject to a remarkable fluctuation of magnitude. When discovered,

this asteroid had a magnitude of 11·3, and on August 31 Dr. Palisa recorded it as being of the eleventh magnitude; at 11h. 44m. (Vienna M.T.) on September 5, however, it had sunk to the twelfth.

The position of this body at 11h. 39·9m. (Königstuhl M.T.) on August 23 was R.A. = 22h. 37·9m., dec. = $-7° 55'$, and on September 5d. 11h. 4·4m. (Vienna M.T.) R.A. = 22h. 27m. 47·3s., dec. = $-9° 5' 45''$.

INTERPRETATION OF SPECTROHELIOGRAPH PICTURES.—In No. 4044 of the *Astronomische Nachrichten*, M. N. Donitch discusses the results obtained by Messrs. Hale and Ellerman, regarding the different chromospheric layers shown on their spectroheliograph negatives, in a new light. He points out that in spectrograms of the chromosphere taken during total eclipses of the sun, the lower layers of the eruptions, *i.e.* those nearer to the moon's limb, appear to be the most extensive, but in Prof. Hale's photographs (plate v., No. 1, vol. xix., of the *Astrophysical Journal*) the opposite appears to be the case, the higher, less dense layers being more extensive than those near to the photosphere.

This discordance between the two results is, in the opinion of M. Donitch, only apparent, and may be explained by the suggestions he advances. He assumes that the inequalities on the surface of the photosphere are so small as to be incomparable with those in the layers of calcium vapour which overlay it. Where this vapour is thin it will only produce the ordinary narrow reversal, producing on the negative a calcium area which is at a low pressure, and, therefore, according to Messrs. Hale and Ellerman, is situated in the upper regions of the chromosphere. This same reversal is also shown by the vapours, which are, in reality, at a greater elevation, so that, using the monochromatic reversal, one obtains on the photograph the forms of the calcium clouds of which the temperature and pressure are relatively low, whatever may be their elevation above the photosphere. For this reason, as M. Donitch believes, the first photograph, which shows more extensive areas of calcium vapour, and according to the Yerkes observers represents simply the upper layers of the disturbed areas, really also represents the thinner extensive layers of vapour which are shown on eclipse spectrograms as the broad bases of the eruptions.

A second photograph taken with the secondary slit set on the *broadened* H reversal ($\lambda = 396·2\ \mu\mu$) only registers those layers of calcium vapour which, being part of a thick layer, are subjected to a sufficient difference of temperature and pressure to produce the broadening; and these may, in many cases, be at a greater elevation than the thin layers shown as part of the "calcium" area on the first photograph.

Similarly in regard to the two photographs shown on plate viii. of Messrs. Hale and Ellerman's paper, M. Donitch believes that it is the second, taken with the secondary slit set at λ 3968·6, that reveals the general distribution of the vapours in projection, whereas the first only reproduces the higher agglomerations of the vapour which dominates the lower layer.

THE OBSERVATORY OF PARIS.—M. Lœwy's report for the year 1904 is far too lengthy to be reviewed as a whole in these columns, but one or two of the more important details may be mentioned. In his introduction, the director mentions the progress made during the year in the Eros campaign, and also indicates how the photographs of the moon, taken for the large atlas he is preparing, afford evidence that the moon, and, inferentially, the planets, solidified from the surface towards the centre.

M. Bigourdan has temporarily arrested his observations of nebulæ with the equatorial of the east tower in order that the dome and instrument may be prepared for the determination of the absolute constant of aberration by M. Lœwy's new method.

A study of the garden meridian circle showed that a difference of $0''·45$ existed between the readings of the two circles. Various possible causes for this discrepancy were examined, and finally it was discovered that the method of illuminating the microscope wires was at fault. The microscopes have been replaced by others, and the difference thereby eliminated.

The astrophysical department is awaiting the arrival of apparatus before making celestial observations, but in the meantime M. Hamy has carried out several laboratory researches, the chief of which related to the constancy of wave-lengths in the solar spectrum. He found that when the temperature of cadmium vapour in a vacuum tube was raised about 15° C., in the neighbourhood of 300° C., the line at λ 508 diminished several units of the order of $1\ \mu \times 10^{-6}$, and he suggests that the variation of temperature in the solar atmosphere may produce similar results.

During 1904, 80 catalogue and 31 *carte* plates were obtained in connection with the *carte du ciel* operations, whilst 67 plates containing 16,656 star-images were measured.

AN ELECTRIC MICROMETER.[1]

THERE is no finality in experimental measurement. In physics it is a common experience for a present-day worker, with better appliances and a wider horizon than his forerunners, to surpass all previous experimental work in accuracy. As knowledge increases it becomes more minutely exact, and nowadays the physicist has often to measure lengths much less than anything visible in any microscope.

There are various means of measuring small distances. We will take them in order, commencing with the least sensitive:—(1) The unaided eye cannot perceive much less than 1/10 millimetre. (2) With the aid of the microscope the eye can see as little as 1/5000 millimetre. (3) The measuring machine used for engineering gauges will detect differences of 1/8000 millimetre. (4) By using interference bands of light we can perceive movements of 1/100,000 millimetre. (5) In the optical lever a beam of light falls on a pivoted mirror; if a body push the mirror at a point very near the axis of the pivot the beam of light is deflected by a large angle. By this means a movement of the body by 1/400,000 millimetre may be detected. (6) The most modern and sensitive method, the electric micrometer, is due to Dr. P. E. Shaw, who produced it in 1900, and has improved it until he can now measure less than 1/2,000,000 millimetre. The nucleus of the apparatus is shown in the figure. A fine screw M has a graduated head N. The screw in rising pushes up the long arm of a lever pivoted at B. The short arm of the lever falls, and in so doing lets down the long arm of a second lever. This process is carried on through six levers, which all rest under their own weight on the blocks shown. The last lever carries a measuring point P, just above which is a measuring surface Q. If the joint leverage of the lever system be 2000/1, an upward movement of the screw point M by 1/1000 millimetre produces an upward movement of P by 1/2,000,000 millimetre.

As a simple example, suppose we wish to find the thermal coefficient of expansion of the rod R, we proceed thus:—Bring P and Q into contact. The screw M is worked up, while a telephone (Tel.), in the electric circuit shown, is on the observer's head. When P touches Q a circuit is completed, and the telephone sounds. Read the graduated disc N. Now lower the temperature of R by any desired amount, taking care that little or no heat reaches the pillars F′ or any part but R. R contracts, and by working screw M up the observer causes P to touch Q again; the telephone sounds, and N is again read. The expansibility can thus be found, when we know the movement of P and the change in temperature.

The screw, the levers, and the frame F′ are all carried by a massive girder I. The whole is surrounded by a box thickly wrapped in felt to minimise temperature changes, and is suspended by long rubber cords from the ceiling, to insulate the measuring apparatus from vibration.

The screw M is not touched by hand, but is worked by a pulley cord of rubber which passes from a hand pulley round pulley O. This is done to avoid the comparatively rough touch and tremor of the hand. There are many precautions as to shape, size, cleanliness, and other matters which must be observed.

[1] Based upon a paper by Dr. P. E. Shaw read before the Royal Society.